Radium isotope measurements from CTD and underway water samples from the R/V Endeavor from 2018-05-06 to 2018-05-29

Website: https://www.bco-dmo.org/dataset/753837
Data Type: Cruise Results
Version: 1
Version Date: 2019-02-11

Project
» Collaborative Research: Impact of the Amazon River Plume on Nitrogen Availability and Planktonic Food Web Dynamics in the Western Tropical North Atlantic (Amazon River Plume Nitrogen)

Contributors	Affiliation	Role
Peterson, Richard N.	Coastal Carolina University	Principal Investigator
Montoya, Joseph P.	Georgia Institute of Technology (Georgia Tech)	Co-Principal Investigator
Subramaniam, Ajit	Lamont-Doherty Earth Observatory (LDEO)	Co-Principal Investigator
Biddle, Mathew	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Radium isotope (223Ra, 224Ra, and 226Ra) measurements from CTD and underway water samples.

Table of Contents

- Deployments
- Project Information
- Funding

Coverage

Spatial Extent: **N**:16.29235 **E**:-50.4593167 **S**:4.89033333 **W**:-57.2567
Temporal Extent: 2018-05-06 - 2018-05-29

Dataset Description

Water samples for radium isotope analysis were collected from both the ship's clean underway intake system ('U' designator in data sheet) and niskin bottles attached to the CTD rosette ('C' designator in data sheet). Salinity data derived from ship's clean underway intake system with SBE 21 SEACAT Thermosaliograph.

Acquisition Description

Water samples were filtered through 47 mm GFF filters (unless otherwise noted), then passed slowly through 25 g (dry) acrylic fibers impregnated with MnO2 (Moore, 1976). Fibers were then washed 10x with Ra-free freshwater to remove salts and dried to a mass between 35 and 57 g for optimal humidity levels (Sun and Torgersen, 1998). Fibers were then immediately counted on a Radium Delayed Coincidence Counter (RaDeCC; Moore and Arnold, 1996) for total Ra-224 and Ra-223. Roughly 3 weeks later, fibers were counted again for supported Ra-224. Thus, excess ('XS') Ra-224 is the difference between total and supported Ra-224 measurements. Ra-226 activities were then measured on a radon emanation line as per Peterson et al. (2009).

Minimum detectable activities (dpm/100L) are calculated based on Currie (1968). Any measured values lower than the minimum detectable activity is labeled 'BD'

Processing Description

BCO-DMO Processing Notes:
- adjusted the date format from mm/dd/yy to yyyy-mm-dd in the columns date and date_time
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions

[table of contents | back to top]

Related Publications

Currie, L. A. (1968). Limits for qualitative detection and quantitative determination. Application to radiochemistry. Analytical Chemistry, 40(3), 586–593. doi:10.1021/ac60259a007 [details], *Methods*

Moore, W. S. (1976). Sampling 228Ra in the deep ocean. Deep Sea Research and Oceanographic Abstracts, 23(7), 647–651. doi:10.1016/0011-7471(76)90007-3 [details], *Methods*

Moore, W. S., & Arnold, R. (1996). Measurement of223Ra and224Ra in coastal waters using a delayed coincidence counter. Journal of Geophysical Research: Oceans, 101(C1), 1321–1329. doi:10.1029/95jc03139 https://doi.org/10.1029/95JC03139 [details], *Methods*

Peterson, R. N., Burnett, W. C., Dimova, N., & Santos, I. R. (2009). Comparison of measurement methods for radium-226 on manganese-fiber. Limnology and Oceanography: Methods, 7(2), 196–205. doi:10.4319/lom.2009.7.196 [details], *Methods*

Sun, Y., & Torgersen, T. (1998). The effects of water content and Mn-fiber surface conditions on measurement by emanation. Marine Chemistry, 62(3-4), 299–306. doi:10.1016/s0304-4203(98)00019-x https://doi.org/10.1016/S0304-4203(98)00019-X [details], *Methods*

[table of contents | back to top]

Parameters

Parameter	Description	Units
U_or_C	Underway (surface) or CTD sample designator	unitless
Station	Station #	unitless
Cast	Cast # at each station	unitless
Date	Local date (EST) sample collected	unitless
Time	Local time (EST) sample collected	unitless
Date_Time	Date and time (GMT) sample collected	yyyy-MM-dd HH:mm
Latitude	Sampling latitude	decimal degrees
Longitude	Sampling longitude	decimal degrees
Depth	Water depth of sample collection	meters (m)
Salinity	Salinity of ship's seawater intake system	unitless
Sample_Volume	Water sample volume	liters (L)
Ra223_Activity	Radium-223 activity	dpm/100L
Ra223_Unc	1-σ analytical uncertainty for Ra223	dpm/100L
XS_Ra224_Activity	Excess radium-224 activity	dpm/100L
XS_Ra224_Unc	1-σ analytical uncertainty for Ra224	dpm/100L
Ra226_Activity	Radium-226 activity	dpm/100L
Ra226_Unc	1-σ analytical uncertainty for Ra226	dpm/100L
Comments	Pertinent notes regarding sample collection	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	niskin bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	niskin bottles attached to the CTD rosette (‘C’ designator in data sheet).
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24 or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	ship’s clean underway intake system
Generic Instrument Name	Pump - Surface Underway Ship Intake
Dataset-specific Description	Water samples for radium isotope analysis were collected from both the ship’s clean underway intake system (‘U’ designator in data sheet)
Generic Instrument Description	The 'Pump-underway ship intake' system indicates that samples are from the ship's clean water intake pump. This is essentially a surface water sample from a source of uncontaminated near-surface (commonly 3 to 7 m) seawater that can be pumped continuously to shipboard laboratories on research vessels. There is typically a temperature sensor near the intake (known as the hull temperature) to provide measurements that are as close as possible to the ambient water temperature. The flow from the supply is typically directed through continuously logged sensors such as a thermosalinograph and a fluorometer. Water samples are often collected from the underway supply that may also be referred to as the non-toxic supply. Ideally the data contributor has specified the depth in the ship's hull at which the pump is mounted.

Dataset-specific Instrument Name	Radium Delayed Coincidence Counter
Generic Instrument Name	Radium Delayed Coincidence Counter
Dataset-specific Description	Radium isotopes (224Ra and 223Ra) were analyzed with a Radium Delayed Coincidence Counter (Moore and Arnold, 1996).
Generic Instrument Description	The RaDeCC is an alpha scintillation counter that distinguishes decay events of short-lived radium daughter products based on their contrasting half-lives. This system was pioneered by Giffin et al. (1963) and adapted for radium measurements by Moore and Arnold (1996). References: Giffin, C., A. Kaufman, W.S. Broecker (1963). Delayed coincidence counter for the assay of actinon and thoron. J. Geophys. Res., 68, pp. 1749-1757. Moore, W.S., R. Arnold (1996). Measurement of 223Ra and 224Ra in coastal waters using a delayed coincidence counter. J. Geophys. Res., 101 (1996), pp. 1321-1329. Charette, Matthew A.; Dulaiova, Henrieta; Gonneea, Meagan E.; Henderson, Paul B.; Moore, Willard S.; Scholten, Jan C.; Pham, M. K. (2012). GEOTRACES radium isotopes interlaboratory comparison experiment. Limnology and Oceanography - Methods, vol 10, pg 451.

Dataset-specific Instrument Name	SBE 21 SEACAT Thermosaliograph
Generic Instrument Name	Sea-Bird SeaCAT Thermosalinograph SBE 21
Dataset-specific Description	Salinity data derived from ship's clean underway intake system with SBE 21 SEACAT Thermosaliograph.
Generic Instrument Description	A platinum-electrode conductivity sensor and a thermistor mounted in a corrosion-resistant plastic and titanium housing designed to be continuously plumbed into a vessel's pumped seawater supply. The instrument may be interfaced to a remote SBE 38 temperature sensor mounted either on the hull or in the seawater inlet. Data are both stored in internal memory and output to a serial port for external logging. Conductivity is measured in the range 0-7 S/m with an accuracy of 0.001 S/m and a resolution of 0.0001 S/m. Housing temperature is measured in the range -5-35C with an accuracy of 0.01 C and a resolution of 0.001 C. Remote temperature is measured in the range -5-35C with an accuracy of 0.001 C and a resolution of 0.0003 C. More information at http://www.seabird.com/products/spec_sheets/21data.htm.

[table of contents | back to top]

Deployments

EN614

Website	https://www.bco-dmo.org/deployment/751104
Platform	R/V Endeavor
Start Date	2018-05-06
End Date	2018-06-01
Description	Cruise associated with project "Collaborative Research: Impact of the Amazon River Plume on Nitrogen Availability and Planktonic Food Web Dynamics in the Western Tropical North Atlantic" (https://www.bco-dmo.org/project/751093)

Project Information

Collaborative Research: Impact of the Amazon River Plume on Nitrogen Availability and Planktonic Food Web Dynamics in the Western Tropical North Atlantic (Amazon River Plume Nitrogen)

Coverage: Amazon River plume

NSF Award Abstract: This is a focused program of field research in waters of the Western Tropical North Atlantic influenced by the Amazon River Plume during the high river flow season. The Amazon Plume region supports diverse plankton communities in a dynamic system driven by nutrients supplied by transport from the river proper as well as nutrients entrained from offshore waters by physical mixing and upwelling. This creates strong interactions among physical, chemical, and biological processes across a range of spatial and temporal scales. The field program will link direct measurements of environmental properties with focused experimental studies of nutrient supply and nutrient limitation of phytoplankton, as well as the transfer of phytoplankton nitrogen to the zooplankton food web. The Amazon Plume exhibits a close juxtaposition of distinct communities during the high-flow season, making it an ideal site for evaluating how nutrient availability, nutrient supply, and habitat longevity interact to drive offshore ecosystem dynamics and function. This project will include German collaborators and will seamlessly integrate education and research efforts. The investigators and their institutions have a strong commitment to undergraduate and graduate education and to increasing the diversity of the ocean science community through active recruiting and training efforts. The team has a strong track record of involving both undergraduate and graduate students in their field and lab research. The two research cruises planned will provide opportunities for students and technicians to interact with an interdisciplinary and international research team. The ultimate objectives of this project are to understand the processes and interactions that promote distinct communities of nitrogen-fixing organisms (diazotrophs) and other phytoplankton around the Amazon Plume and to explore the impacts of these diazotroph-rich communities on zooplankton biomass and production. The research team includes scientists with expertise in nutrient and stable isotope biogeochemistry, remote sensing as well as specialists in characterizing water mass origin and history using naturally occurring radium isotopes. This combination of approaches will provide a unique opportunity to address fundamental questions related to plankton community structure, primary production, and links to secondary production in pelagic ecosystems. The project will address the following key questions focused on fundamental issues in plankton ecology resulting from previous research in this region: A. What mechanisms promote the preferential delivery of bioavailable phosphorus and the resulting strong nitrogen limitation associated with the northern reaches of the Amazon Plume during the high flow season? B. What factors lead to the clear niche separation between diazotrophs within and around the Amazon Plume and how are the distinct diazotroph communities influenced by hydrographic and biogeochemical controls associated with the Amazon River Plume and offshore upwelling processes? C. How does the nitrogen fixed by the different types of diazotrophs contribute to secondary production, and how efficiently does diazotroph nitrogen move through the food web?

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1736947

[table of contents | back to top]